

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE N/A	PAGE 1 OF 42 PAGES
2. AMENDMENT/MODIFICATION NO. 0002	3. EFFECTIVE DATE JAN. 12, 2004	4. REQUISITION/PURCHASE REQ. NO. N/A	5. PROJECT NO. (If applicable) SPEC. NO. 1331	
6. ISSUED BY CODE		7. ADMINISTERED BY (If other than Item 6) CODE		
DEPARTMENT OF THE ARMY U.S. ARMY ENGINEER DISTRICT, SACRAMENTO SACRAMENTO, CALIFORNIA 95814-2922		DEPARTMENT OF THE ARMY U.S. ARMY ENGINEER DISTRICT, SACRAMENTO SACRAMENTO, CALIFORNIA 95814-2922		

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(✓)	9A. AMENDMENT OF SOLICITATION NO. W91238-04-R-0004
	×	9B. DATED (SEE ITEM 11) DEC. 22, 2003
		10A. MODIFICATION OF CONTRACTS/ORDER NO. N/A
		10B. DATED (SEE ITEM 13) N/A
CODE	FACILITY CODE	

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
N/A

NOTE: ITEM 13 BELOW IS N/A.

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(✓)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A. N/A
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority) N/A

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Global Hawk Upgrade Dock 3
Beale AFB, CA

**NOTE: Drawing Sheet C-102 shall read 6 of 166.
Drawing Sheet C-102A is correct and shall remain 7 of 166.**

2 Encl

1. Revised Pages: Page 6, Index Section 01505, 01505-13, Section 13209, Section 13959
2. Revised Drawings: G-002,A-201,F-202,F-400,F-401,F-402,F-403,F-500,F-501,F-503,F-600,F-601,FA601

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY	16C. DATE SIGNED
(Signature of person authorized to sign)		(Signature of Contracting Officer)	

INSTRUCTIONS

Instructions for items other than those that are self-explanatory, are as follows:

- (a) Item 1 (Contract ID Code). Insert the contract type identification code that appears in the title block of the contract being modified.
- (b) Item 3 (Effective date).
- (1) For a solicitation amendment, change order, or administrative change, the effective date shall be the issue date of the amendment, change order, or administrative change.
- (2) For a supplemental agreement, the effective date shall be the date agreed to by the contracting parties.
- (3) For a modification issued as an initial or confirming notice of termination for the convenience of the Government, the effective date and the modification number of the confirming notice shall be the same as the effective date and modification number of the initial notice.
- (4) For a modification converting a termination for default to a termination for the convenience of the Government, the effective date shall be the same as the effective date of the termination for default.
- (5) For a modification confirming the contracting officer's determination of the amount due in settlement of a contract termination, the effective date shall be the same as the effective date of the initial decision.
- (c) Item 6 (Issued By). Insert the name and address of the issuing office. If applicable, insert the appropriate issuing office code in the code block.
- (d) Item 8 (Name and Address of Contractor). For modifications to a contract or order, enter the contractor's name, address, and code as shown in the original contract or order, unless changed by this or a previous modification.
- (e) Items 9, (Amendment of Solicitation No.-Dated), and 10, (Modification of Contract/Order No.-Dated). Check the appropriate box and in the corresponding blanks insert the number and date of the original solicitation, contract, or order.
- (f) Item 12 (Accounting and Appropriation Data). When appropriate, indicate the impact of the modification on each affected accounting classification by inserting one of the following entries:
- (1) Accounting classification
Net increase \$
- (2) Accounting classification
Net decrease \$
- NOTE: If there are changes to multiple accounting classifications that cannot be placed in block 12, insert an asterisk and the words "See continuation sheet".
- (g) Item 13. Check the appropriate box to indicate the type of modification. Insert in the corresponding blank the authority under which the modification is issued. Check whether or not contractor must sign this document. (See FAR 43.103.)
- (h) Item 14 (Description of Amendment/Modification).
- (1) Organize amendments or modifications under the appropriate Uniform Contract Format (UCF) section headings from the applicable solicitation or contract. The UCF table of contents, however, shall not be set forth in this document.
- (2) Indicate the impact of the modification on the overall total contract price by inserting one of the following entries:
- (i) Total contract price increased by \$
- (ii) Total contract price decreased by \$
- (iii) Total contract price unchanged.
- (3) State reason for modification.
- (4) When removing, reinstating, or adding funds, identify the contract items and accounting classifications.
- (5) When the SF 30 is used to reflect a determination by the contracting officer of the amount due in settlement of a contract terminated for the convenience of the Government, the entry in Item 14 of the modification may be limited to -
- (i) A reference to the letter determination; and
- (ii) A statement of the net amount determined to be due in settlement of the contract.
- (6) Include subject matter or short title of solicitation/contract where feasible.
- (i) Item 16B. The contracting officer's signature is not required on solicitation amendments. The contracting officer's signature is normally affixed last on supplemental agreements.

* QUANTITY IS AN ESTIMATED AMOUNT. SEE SECTION 00700, FAR 52.211-18, FOR VARIATION IN ESTIMATED QUANTITY CONTRACT CLAUSE.

1. Prices must be submitted on all individual items of this Pricing Schedule. Failure to do so may cause the proposal to be determined "unacceptable".
2. If a modification to a price is submitted which provides for a lump sum adjustment to the total price, the application of the lump sum adjustment to each item in the Pricing Schedule must be stated. If it is not stated, the bidder/offeror agrees that the lump sum adjustment shall be applied on a pro rata basis to every item in the Pricing Schedule.
3. The bidder/offeror shall distribute his indirect costs (overhead, profit, bond, etc.) over all the items in the Pricing Schedule. The Government will review all submitted Pricing Schedules for any unbalancing of the items. Any submitted Pricing Schedule determined to be unbalanced may cause the proposal to be determined "unacceptable".
4. The lump sum, "LS", line items above are not "estimated quantity" line items and therefore are not subject to the Variation in Quantity contract clause.
5. The successful bidder/offeror grants the options listed in the Pricing Schedule to the Government. This option may be exercised any time up to 120 days after receipt of Notice to Proceed. Exercise of the option occurs upon mailing of written notice to the Contractor. Exercise will be made by the Contracting Officer. The price for exercise of the option includes all work and effort associated with the scope of that item. No additional time for contract completion will be allowed when an option is exercised. The given contract completion time was formulated to include time necessary to perform all option work.
6. *The target ceiling for contract award for construction is \$8,100,000.00 based on the funds made available for this project. The Government cannot guarantee that additional funds can be made available for award. Offerors are under no obligation to approach this ceiling.*

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1.17 AFTER AWARD DOCUMENTS

(a) After AWARD the Government will provide to the Contractor, without charge, one copy of AWARD CD with drawings and specifications, which shall include conformed .CAL drawing files, conformed .pdf specification files, downloadable submittal register program, and original solicitation drawings and specifications plus all amendments.

(b) The Contractor shall reproduce five (5) hard copy sets from AWARD CD, conformed drawings and specifications that shall be sent directly to the Resident Engineer's Office. The hard copy drawings shall be ANSI D (22" x 34"), and the specifications shall be standard 8-1/2" x 11", 3-hole punched. The Contractor shall provide these documents with 5 work days of the receipt of the AWARD CD from the Government.

(c) See the following clause in Section 00700 for additional information: DFARS 252.236-7001 CONTRACT DRAWINGS AND SPECIFICATIONS.

PART 2 PRODUCTS (NOT USED)

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SECTION 13209N

WATER STORAGE TANKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B40.1	(1991; Special Notice 1992) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1998; Rev A) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
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AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water and Other Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1994) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C508	(1993) Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS
AWWA C652	(1992) Disinfection of Water-Storage Facilities
AWWA D100	(1996) Welded Steel Tanks for Water Storage
AWWA D101	(1953; R 1986) Inspecting and Repairing Steel Water Tanks, Standpipes, Reservoirs, and Elevated Tanks, for Water Storage

AWWA D103 (1997) Factory-Coated Bolted Steel Tanks
for Water Storage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27 Fixed Ladders

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check
Valves

NACE INTERNATIONAL (NACE)

NACE RP0178 (1995) Fabrication Details, Surface Finish
Requirements, and Proper Design
Considerations for Tanks and Vessels to be
Lined for Immersion Service

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 22 (2003) Water Tanks for Private Fire
Protection

NFPA 170 (2002) Fire Safety Symbols

1.2 DEFINITIONS

- a. Year 2000 compliant-means computer controlled facility components that accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twentyfirst centuries, and the years 1999 and 2000 and leap year calculations.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Tanks & Foundations; G

Submit shop drawings for approval. Indicate types, sizes, locations, plate thicknesses, installation details, and other construction details. Provide design calculations for lateral forces. Tank design and installation shall comply with NFPA 22, including appendix material. A qualified registered engineer shall perform design including seismic designation and shall sign and stamp plans and calculations. Comply with NFPA 170 for symbols.

SD-03 Product Data

Tanks including accessories and components

Include detail specifications, available performance test data, and instructions for installation and maintenance.

SD-06 Test Reports

Mill test on steel tank plates

Mill test on structural steel

SD-07 Certificates

Year 2000 (Y2K) Compliance Warranty

Tanks

Foundations

SD-08 Manufacturer's Instructions

Before application of coating systems, submit printed instructions which include brand names, catalog numbers, detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures.

SD-10 Operation and Maintenance Data

Water storage tank, Data Package 1

1.4 DELIVERY AND STORAGE

Handle and store water storage tank systems, components, and parts to prevent distortions and other damage that could affect their structural, mechanical, or electrical integrity. Replace damaged items that cannot be restored to original condition. Store items subject to deterioration by exposure to elements, in a well-drained location, protected from weather, and accessible for inspection and handling. Deliver paint in unopened containers with unbroken seals and labels showing designated name, specification number, color, directions for use, manufacturer, and date of manufacture, legible and intact at time of use.

1.5 QUALITY ASSURANCE

1.5.1 Tanks and Foundations

Certificate signed by a registered professional engineer shall provide: (1) description of the entire tank and foundation structural design loading conditions, (2) description of structural design methods and codes used in establishing allowable stresses and safety factors, (3) statement that the structural design has been checked by experienced engineers specializing in hydraulic structures to ensure that design calculations for member sizes, dimensions, and fabrication processes are as prescribed by ACI and AWWA standards, and (4) certification that the completed work was inspected in accordance with AWWA D100 or AWWA D103 as applicable.

1.6 WARRANTY

1.6.1 Year 2000 (Y2K) Compliance Warranty

For each product, component and system specified in this section as a "computer controlled facility component" provide a statement of Y2K compliance warranty for the specific equipment. The contractor warrants that each hardware, software, and firmware product delivered under this contract and listed below shall be able to accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations to the extent that other computer controlled components, used in combination with the computer controlled component being acquired, properly exchange data and time data with it. If the contract requires that specific listed products must perform as a system in accordance with the foregoing warranty, then that warranty shall apply to those listed products as a system. The duration of this warranty and the remedies available to the Government for breach of this warranty shall be defined in, and subject to, the terms and limitations of the contractor's standard commercial warranty or warranties contained in this contract, provided that, notwithstanding any provisions to the contrary, in such commercial warranty or warranties, the remedies available to the Government under this warranty shall include repair or replacement of any listed product whose non-compliance is discovered and made known to the contractor in writing within one year (365 days) after acceptance. Nothing in this warranty shall be construed to limit any rights or remedies the Government may otherwise have under this contract, with respect to defects other than Year 2000 performance.

1.7 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 Y2K Compliant Products

Provide computer controlled facility components, specified in this section, that are Year 2000 compliant (Y2K). Computer controlled facility components refers to software driven technology and embedded microchip technology. This includes, but is not limited to, telecommunications switches, utility monitoring and control systems, fire detection and suppression systems, alarms, and other facilities control systems utilizing microcomputer, minicomputer, or programmable logic controllers.

2.2 EQUIPMENT

Two steel ground storage reservoirs with a minimum storage capacity of 50000 gallons each. Existing grade at tank site shall be as indicated . .

2.3 MATERIALS

2.3.1 Tanks

AWWA D100 for welded tanks. Tanks shall be nominal capacity 50,000 gallon tanks, 45,000 gallon effective capacity (bottom of overflow pipe to top of suction nozzle). Tanks shall be constructed in accordance with NFPA 22, all provisions of Appendix A of NFPA 22 shall be considered mandatory.

2.3.2 Pipe and Fittings

2.3.2.1 Piping

Underground PVC Pipe

Underground pipe shall be C-900 PVC per specification section 02510A.

Aboveground Ductile-Iron Pipe

For above ground locations, valve vaults, and optionally in other locations, AWWA C115, flanged joints, Pressure Class 250 . Fittings, AWWA C110, Class 250 or Class 150 for 14 inches and larger, flanged mechanical or push-on joint , cement mortar-lined. Joints for push-on and mechanical joints shall conform to AWWA C111.

2.3.2.2 Steel Pipe, 2 Inches Under in Size

ASTM A 53, zinc-coated, Schedule 40. Fittings, ASME B16.3, ASME B16.5, ASME B16.9 Type II, for threaded pipe.

2.3.2.3 Insulating Joints

Design insulating joints to effectively prevent metal-to-metal contact at joint between adjacent sections of piping of dissimilar metals. Joint shall be of flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and as recommended in the Appendix to AWWA C115. Provide bolts and nuts as recommended in AWWA C115.

2.3.3 Valves

2.3.3.1 Gate Valves

Conform to Section 02510A, "Water Distribution System."

2.3.3.2 Check Valves

AWWA C508, horizontal swing check valve, flanged ends, and composition to metal seat.

2.3.3.3 Valves, 2 Inches and Smaller in Size

MSS SP-80, gate valve, Type 1, 2, 3 or 4, Class 125.

2.3.3.4 Tank Fill Valve

Control supply to the tank by a 6 inch altitude tank fill valve, automatic in operation and accurately set to prevent tank overflow. Valve shall have flanged ends and a heavy cast-iron body, bronze-fitted with renewable cups

and seats, and designed without metal-to-metal seats. Cushion valve when opening and closing to prevent water hammer or shock. Valve shall operate by pilot control. Provide sensing line connected directly to the tank. Insulate sensing line and valves.

2.3.3.5 Tank Suction Pipe

Suction piping shall include an anti vortex plate as required by NFPA 22.

2.3.4 Pressure Gage

Direct-reading type equipped with shut-off cock in valve chamber on tank side and on discharge side of check tank fill valve, and 6 inch dials, stem mounted, conforming to ASME B40.1, Accuracy Grade 1A. Calibrate gages in pounds per square inch in not more than 2 pound increments from 0 to 50 pounds in excess of normal operating pressure at tank.

2.3.5 Coating Systems for Welded Tanks

Provide exterior coating systems conforming to Section 09971, "Exterior Coating of Steel Structures," and interior coating systems conforming to Section 09972, "Interior Coating of Welded Steel Water Tanks." Provide a corrosive protective coating system to the underside of the tank bottom that is compatible with the concrete foundation. Comply with NFPA 22, 5.6.7.

2.3.6 Concrete Work

Provide as specified in Section 03300, "Cast-In-Place Structural Concrete and Stamped Cement Concrete Pavement."

PART 3 EXECUTION

3.1 INSTALLATION

Design and fabricate tank to comply with NACE RP0178. Finish tank interior surfaces in accordance with Section 4 of NACE RP0178, and accompanying Visual Comparator, to the condition described and shown for NACE Weld Designation "C" welds. Finish tank exterior surfaces in accordance with Section 4 of NACE RP0178, and accompanying Visual Comparator, to condition described and shown for NACE Weld Designation "D" welds. Appendix B of NACE RP0178 is not included in this requirement. Installation shall fully comply with NFPA 22 including Appendix A with all provisions being considered mandatory except a tank heater is not required.

3.1.1 Welded Storage Tank

The tanks shall be designed, installed and tested in full compliance with NFPA 22.

Comply with the following except where it conflicts with NFPA22. In that case, comply with NFPA 22.

Install in accordance with applicable requirements of AWWA D100. Applicable requirements set forth by the following designated sections thereof shall govern, unless otherwise specified:

- a. Materials: Section 2.

- b. General Design: Section 3. Design for wind velocity of 85 MPH. Earthquake resistance required, using design percentages for zone 3 .
- c. Sizing : . Steel ground storage reservoir, Section 6.
- d. Welding: Section 8.
- e. Shop Fabrication: Section 9.
- f. Erection: Section 10.
- g. Inspection and Testing: Section 11.
- h. Accessories for Steel Ground Storage Reservoir: Section 7 with the following additional or modified requirements. Safety devices; screened vent; pipe connection of 10 inches in diameter. Overflow shall be to ground of 6 inches in diameter. Install a sufficient number of minimum 1 1/2 inch diameter anchor bolts, designed to prevent overturning of tank when empty, and set deep enough to resist computed uplift or design capacity, if greater. Bend anchors 90 degrees for anchorage in concrete, or provide with properly designed anchor plates. Attach anchor bolts to tank shell with properly designed anchor bolt chairs made of structural steel or bent plates. .

3.1.1.1 Foundations

Construct in accordance with AWWA D100 and as specified in structural specifications and shown on structural drawings. The details and configuration indicated for the water storage tank and foundation are illustrative of the general requirements. If foundation design modifications are necessitated by modifications to the configuration of the tank, a complete design, including calculations prepared by a registered engineer, shall be submitted for approval. The Contractor shall verify that the indicated foundation design is applicable for the submitted tank. All costs associated with the design and construction of modified tanks and foundations shall be at the expense of the Contractor.

3.1.2 Fixed Ladders

29 CFR 1910.27. Install ladder safety devices for ladders over 20 feet in unbroken length.

3.1.3 Safety Railings

Provide OSHA compliant railing around all roof manholes and other accessories that require access per NFPA 22, 4.14.11.

3.1.4 Vents

Provide permanent tank vents that are flanged to comply with NFPA 22, 4.15.11 for exhaust fan connection.

3.2 PIPING SYSTEM TEST

After tank erection and installation of valves and piping, and prior to field painting, test exterior piping in accordance with Section 02510A,

"Water Distribution System" . Replace defective material disclosed by pressure test and repeat test until results are satisfactory.

3.3 COATING OF WELDED TANKS

After all tank tests have been completed, coat exterior tank surfaces and appurtenances as specified in Section 09971, "Exterior Coating of Steel Structures" and coat interior tank surfaces as specified in Section 09972, "Interior Coating of Welded Steel Water Tanks." Provide a corrosive protective coating system to the underside of the tank bottom that is compatible with the concrete foundation. Comply with NFPA 22, 5.6.7.

3.4 INSPECTION AND REPAIR OF STEEL TANKS

Prior to tank repair job, perform a detailed inspection of the structure and submit report by a certified inspector. Inspection and repair of steel water tanks for water storage shall be in accordance with AWWA D101 and NFPA 22.

3.5 CLEANING OF TANKS

Tank fill piping shall be completely flushed, cleaned and accepted prior to any water being introduced into the tanks (NFPA 22). Tank shall be disinfected in accordance with ANSI/AWWA D100-96 and ANSI/AWWA C652.

3.6 ACCEPTANCE TEST

A tank final acceptance test, per NFPA 22 shall be performed after all other preliminary tests have been completed and test reports approved. Take all recommendations of Appendix A of NFPA 22 as mandatory. This shall include tank bottom testing that complies with NFPA 22, 5.6.8.1.

3.7 TANK WATER FILLING

The tanks shall be filled with water only after the final acceptance test has been completed and approved.

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SECTION 13959

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SECTION 13959

HIGH EXPANSION FOAM (HI-EX) FIRE PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1998) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123	(1997; Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 216	(1993; R 1998) Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A 312/A 312M	(2002) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 403/A 403M	(2002) Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 536	(1999e1) Ductile Iron Castings
ASTM B 61	(1993) Steam or Valve Bronze Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1999) Malleable Iron Threaded Fittings 98'
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B31.1	(1995) Power Piping
ASME BPVC SEC VIII	(1995; Addenda 1995) Boiler and Pressure Vessel Codes: Section VIII Pressure Vessels

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606 (1997) Grooved and Shouldered Joints

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check
Valves

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (1998) Approval Guide Fire Protection

FM P7825b (1998) Approval Guide Electrical Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 11 A (1999) Medium and High-Expansion Foam
Systems

NFPA 13 (2002) Installation of Sprinkler Systems

NFPA 20 (1999) Installation of Centrifugal Fire
Pumps

NFPA 24 (2002) Installation of Private Fire
Service Mains and Their Appurtenances

NFPA 70 (2002) National Electrical Code

NFPA 72 (2002) National Fire Alarm Code

NFPA 170 (2002) Fire Safety Symbols

UNDERWRITERS LABORATORIES (UL)

UL 262 (1994; R 1998) Gate Valves for
Fire-Protection Service

UL 312 (1993; R 1994) Check Valves for
Fire-Protection Service

UL 393 (1996) Standard for Indicating Pressure
Gauges for Fire-Protection Service

UL 486A (1997; R 2001, Bul. 2002, 2003) Wire
Connectors and Soldering Lugs for Use with
Copper Conductors

UL 486B (1997; R 2001, Bul. 2002, 2003) Wire
Connectors for Use with Aluminum Conductors

UL Bld Mat Dir (1999) Building Materials Directory

UL Fire Prot Dir (2003) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

The system shall consist of an automatic high expansion foam fire protection system and shall be provided for the areas indicated on the drawings. Except as modified herein, the system shall meet the requirements of NFPA 11A, NFPA 24 and NFPA 72. Pipe sizes shall be determined by the hydraulic calculations. The Contractor shall design any portion of the foam system not shown on the foam system drawings. The drawings depict a layout based on one manufacturer's equipment. The Contractor shall verify that the selected equipment will perform as herein required or make all associated changes required to provide a complete operating system at no additional cost to the government. The Contractor shall provide calculations showing that all components of the system that he/she proposes will meet the criteria required by these documents. The Contractor shall follow the drawings except to make adjustments to accommodate the selected equipment. General deviations from these drawings will not be allowed just for the Contractors convenience or preference.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to provide the required quantity of foam using the selected foam generators. Hydraulic calculations shall be performed as required by NFPA 13. The foam system hydraulic calculations shall be balanced with the wet pipe sprinkler system calculations. See Section 13930 WET PIPE SPRINKLER SYSTEM FIRE PROTECTION for additional hydraulic calculation requirements. Water velocity in the piping shall not exceed 20 ft/s.

Demand calculations shall be performed to verify that the water supply can provide adequate flow and pressure for concurrent operation of hangar bay sprinkler system and foam system. No hose allowance is required for this calculation.

Supply calculations shall be performed to prove that under any discharge conditions, the water tanks, fire pumps and foam tank are adequately sized to meet the design requirements of the sprinkler and foam systems. These shall include foam system only, foam system and most remote 5000 square feet of sprinkler system and foam system and least demanding 5000 square feet of sprinkler system.

The sprinkler system in Dock 6 has been designed by a Contractor under another contract. The Contractor performing this work shall coordinate to make sure this requirement is met in Dock 6 as well as his/her own design for Dock 3. The Contractor shall size piping in such a manner to prove the size of the pumps and tanks is adequate or provide pumps and tanks (and all related project revisions) that do comply at no additional cost to the government. See Section 13930A WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION for demands of wet pipe sprinkler system in Dock 6.

1.2.2 Basis for Calculations

Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 100 for normally "dry" steel pipe, 120 for wet steel pipe and 150 for PVC underground pipe. Hydraulic calculations shall be based on two of three fire pumps operating.

1.3 SUMMARY

This Section includes fixed, high expansion, fire-extinguishing systems and the following:

- a. Piping and piping specialties
- b. Foam concentrate tank and proportioning devices
- c. Foam concentrate
- d. Discharge devices
- e. Valves
- f. Deluge valve-releasing panel

1.4 SYSTEM DESCRIPTION

Engineered, fixed-type, high-expansion, foam fire-extinguishing system for hydrocarbon-liquid fires. System includes diaphragm proportioning tanks and devices as described in NFPA 11 A.

1.5 PERFORMANCE REQUIREMENTS

Failure to achieve these requirements during acceptance testing will indicate a system failure. Contractor shall make modifications to obtain acceptable operations with no additional cost to the Owner.

Low-level high-expansion foam system must cover 90 percent of the aircraft silhouette area projected on the floor in one minute or less. The area under engines extend beyond the wing edge and under rear elevators does not have to be considered in the aircraft's silhouette area.

Low-level high-expansion foam systems must cover the aircraft servicing area and adjacent accessible areas to a depth of 3.2 feet (one meter) in four minutes or less.

1.5.1 Rate of Discharge

The minimum rate of discharge or total generator capacity will be calculated in accordance with NFPA 11A; however, it will never be less than 0.8 m³/min/m² (2.6 ft³/min/ft²). Application rates in the range of 0.8 to 1.2 m³/min/m² (2.6 to 4 ft³/min/ft²) are required to meet the performance requirements.

The minimum rate of discharge or total generator capacity will be calculated from the following formula:

$$R = ([V/T] + R_s) \times CN \times CL$$

where:

R = Rate of discharge in m³/min (ft³/min)

V = Submergence volume in m³ (ft³) determined by the following formula: $V = A \times D$

where:

A = Area of the aircraft servicing floor and adjacent floor areas not cut off from the aircraft servicing floor m² (ft²)

D = Depth = One meter (3.28 feet) which is greater than the 0.6 meter (2

foot) minimum foam depth over the hazard required in NFPA 11A.

T = Submergence time in minutes = 4

Rs = Rate of foam breakdown by sprinklers in ft³/min (m³/min) determined by the following formula:

$$R_s = S \times Q$$

where:

S = Foam breakdown from sprinkler discharge = 0.0748 cubic meters per minute X L/min (10 cubic feet per minute X gpm)

Q = Estimated total discharge from maximum number of sprinklers expected to operate in L/min (gpm).

CN = Compensation for normal foam shrinkage = 1.15. This is an empirical factor based on average reduction in foam quantity from solution drainage, fire, wetting of surfaces, and absorbency of stock.

CL = Compensation for loss of foam due to leakage around doors and windows and through unclosable openings determined by the design engineer after proper evaluation of the structure. The factor for Air Force hangars cannot be less than 2.0 for hangars less than 1394 square meters (15,000 square feet), 2.5 for hangars less than 2787 square meters (30,000 square feet), and 3.0 for all other hangars.

1.5.2 Concentrate and Water Supply

Concentrate and water supply will permit continuous operation of the system to generate four times the submergence volume, but for not less than 15 minutes.

1.5.3 Activation

The following will activate the low-level high-expansion foam systems:

- a. Manual foam activation stations located as shown on drawings.
- b. Water flow signal in overhead sprinkler systems.

1.5.4 Proportioning

Use pressure proportioners for all bladder systems.

1.5.5 Control Valve

Provide water-powered ball valves as foam concentrate control valves. The valve must be operated by connection to the alarm line of the automatic water control valve or alarm valve. Provide a retard chamber in the line to the water-powered ball valve on wet pipe foam water systems.

1.5.6 Application Time

For low-level high-expansion generators provide a connected foam concentrate supply sized for a single 15-minute application (or four times the submergence volume, whichever is greater) of foam.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

High Expansion Foam Systems; G

Detail drawings conforming to the requirements prescribed in NFPA 13 which are signed and sealed by a qualified professional engineer; drawings shall be 30 x 42 inches. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
- b. Floor plans drawn to a scale not less than 1/8 inch equals 1 foot clearly showing locations of devices, equipment, risers, electrical power connections, areas covered by each generator, and other details required to clearly describe the proposed arrangement.
- c. Piping plan for Hi-Ex system. Generators and associated piping shall be shown. Abbreviated presentation forms will not be accepted. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be identified. A separate plan shall be provided for each overhead sprinkler system and each nozzle system.
- d. Piping plan and isometric drawing of the concentrate system and details of all associated valves, fittings, and other components. Drawing shall indicate all operational feature.
- e. Location of control panels, detectors, manual stations, supervisory switches, solenoids, notification appliances, and other electrical devices. In addition, conduit routing and sizes, and the number of conductors contained in each shall be indicated.
- f. Longitudinal and transverse building sections showing typical pipe routing and elevation above finished floor.
- g. Equipment room layout drawings drawn to a scale of not less than 1/2 inch equals 1 foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
- h. Details of each type of pipe hanger, sway bracing for earthquake protection, restraint of underground water main at point-of-entry into the building, proportioners, ~~nozzles~~**foam generators, foam tanks**, and mounting details, foam system control valve header and related components. **Include bracing for foam generators and foam tanks. Design for seismic zone 3 per NFPA 13.**
- i. Connection drawings and control diagrams indicating overall

electrical and mechanical operation of the foam system. This shall include identification and operation of each major component of the system. Diagrams shall be supplemented with a narrative description of the system. Point-to-point wiring diagrams shall indicate foam system control panel wiring and make and model of devices and equipment connected thereto.

As-built Drawings; G,

One set of reproducible and six copies, within 14 calendar days after successful completion of required testing. A separate set of approved submittal drawings of the overall system, marked up to indicate as-built conditions, shall be maintained on site. These drawings shall be maintained in a current condition at all times and shall be made available for review immediately upon request during normal working hours. Variations from the approved drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials, and/or required for coordination between trades shall be indicated in sufficient detail to accurately reflect the as-built conditions.

SD-03 Product Data

Materials and Equipment; G,

Manufacturer's catalog data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list with equipment description, model number, and quantity shall be provided.

Spare Parts; G,

Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Foam Systems; G,

A copy of the proposed diagrams and instructions for the overall foam system, prior to posting.

Installer's Qualifications; G,

Data approved, prior to submittal of any other data or drawings, to substantiate that the proposed installer is regularly engaged in the installation of the type and complexity of fire protection system included in this project. Data shall identify the location of three systems recently installed by the proposed installer which are comparable to the system specified. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

Post-discharge Test Requirements; G,

Details of method proposed for required tests at Final Acceptance, including step-by-step test procedures; list of equipment to be used; names, titles, and affiliations and qualifications of personnel who will participate in the tests; methods for protecting the facility and equipment during testing; means for containing the foam solution during discharge tests; and proposed means for disposal. Test plan shall include a drawing showing proposed number and arrangement of fire hoses and nozzles proposed for use in testing foam proportioners. Blank forms the Contractor plans to use to record test results shall be included.

SD-05 Design Data

Hydraulic Calculations; G,

Provide hydraulic calculations complying with the requirement of this Section and Section 13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION. Calculations shall be signed and sealed by a qualified professional engineer.

SD-06 Test Reports

Tests; G,

Test Plan: Test plan shall be complete in describing what measurements are to be made and how they will be collected. Include copies of proposed data collection forms and test reports. Clearly describe what tests are to be conducted, what data is to be collected, acceptable findings, corrective action for failure to meet acceptable findings, equipment required, personnel required, notification procedure for notifying contracting officer, list of manufacturers employees to assist, integration of test for sprinkler systems, fire pumps, high expansion foam, and fire alarm systems.

Provide separate test plans for Dock 3 and Dock 6. Both shall verify that the fire pumps are adequate to support the dock fire protection systems.

Reports for tests, as follows:

- a. Reports as outlined in NFPA 13 documenting results of flushing and hydrostatic tests.
- b. Trip tests of wet pipe sprinkler system and foam deluge system.
- c. Test report of foam concentrate proportioning system. Report shall include all pressure readings and settings of system components. Report shall include conductivity readings for foam samples taken from each AFFF proportioner. Report shall be signed by the factory-trained technical representative employed by the foam concentrate manufacturer.
- d. Test report of the foam system control panel and initiating and indicating devices. Report shall include a unique identifier for each device with an indication of test results. Report shall be signed by the factory-trained technician employed by the control panel manufacturer.
- e. Videotapes of tests specified to be recorded.

SD-07 Certificates

Qualifications of Installer

Materials and Equipment; G,

Certificates from manufacturers to substantiate that components, equipment and material proposed for installation and use meet requirements as specified, concurrent with submittal of manufacturer's catalog data of equipment proposed for installation. Certificates shall be on a form for this purpose or on official letterhead of the manufacturer with specified information stated as required. Certificate shall be signed by an officer of the corporation. Certificates shall be provided for the following:

- a. Foam concentrate. Certification that concentrate proposed for use has been tested and is in compliance with approved specifications.
- b. Concentrate control valve. Certification that the valve is designed and, constructed as specified and will function as intended.
- c. Proportioning system. Certification that the foam proportioning system complies with contract specifications and manufacturer's recommendations.
- d. Control panel. Certification that the control panel releasing module is electrically compatible with the electrically-actuated automatic water control valve.
- e. Gaskets. Certification from the foam manufacturer that the foam concentrate and foam/water solution is compatible with all gasket materials that it will contact in this system.
- f. Foam Containment and Disposal Plan.
- g. Compliance with foam system control panel ground fault detection requirement.

SD-10 Operation and Maintenance Data

Foam System; G,

Manuals in loose-leaf binder format and grouped by technical sections consisting of manufacturer's brochures, schematics, printed instructions, general operating procedures, and safety precautions. Manuals shall include a narrative description of the sequence or sequences of operation of the overall fire protection system and a separate description for each major subsystem. Information to be provided shall include specific settings for all adjustable valves. The manuals shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout, and simplified wiring and control diagrams for the system as installed. The manuals shall include procedures and instructions pertaining to frequency of preventive maintenance,

inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

SD-11 Closeout Submittals

As-built drawings for the fire extinguishing system; G

Video tape of preliminary and final Hi-Ex foam discharge test

1.7 SUBMITTAL PREPARER'S QUALIFICATIONS

1.7.1 Engineer Qualification

The Contractor (prime or sub) shall have on staff or under contract a qualified and experienced Fire Protection Engineer (FPE).

The engineer must be a qualified FPE meeting one of the following requirements:

- a. Bachelor of Science or Master of Science degree in fire protection engineering from an accredited university, plus a minimum of five (5) years work experience in fire protection engineering.
- b. Professional Engineer (PE) registration by examination, National Council of Examiners for Engineering and Surveys (NCEE) fire protection engineering written examination.
- c. Qualification as GS/GM 804-series FPE.
- d. PE registration in a related discipline with minimum five (5) years experience in fire protection engineering.

The FPE shall be responsible for performing and overseeing all engineering aspects of the fire protection system construction, including, but not limited to calculations, layout, shop drawings, equipment selection and inspections. In addition, this person(s) shall be responsible for the testing plan and for final commissioning and testing of the system.

1.8 INSTALLER'S QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of fire protection system included in this project. A statement prior to submittal of any other data or drawings, that the proposed installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the locations of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.9 REGULATORY REQUIREMENTS

The advisory provisions of NFPA standards and recommended practices specified shall be considered mandatory, as though the word "shall" had been substituted for "should" wherever it appears. In the event of a conflict between referenced NFPA standards and this specification, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.10 QUALITY ASSURANCE

1.10.1 Source Limitations

Obtain foam concentrate, proportioning tanks, and major accessories through one source. All components shall be listed for use together as single system.

1.10.2 Product Options

Drawings indicate size, profiles, and dimensional requirements of foam fire-extinguishing systems and are based on the specific system indicated. Other manufacturers' foam fire-extinguishing systems complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

1.10.3 Code Compliance

1.10.3.1 Electrical Components, Devices and Accessories

Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.10.3.2 NFPA Compliance

Fabricate and label foam fire-extinguishing systems to comply with NFPA 11 A, except where contract documents provide specific criteria which is different than NFPA.

1.10.3.3 ASME Compliance

Fabricate piping to comply with ASME B31.1

1.10.3.4 UL Compliance

Provide foam concentrate and equipment complying with UL and with systems that are listed in UL's "Fire Protection Equipment Directory." Equipment must be listed with concentrate provided.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 REQUIREMENTS FOR FIRE PROTECTION SERVICE

All equipment and material shall have been tested by Underwriters Laboratories, and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.

2.3 PRESSURE RATINGS

Valves, fittings, couplings, proportioners, alarm switches, strainers, and similar devices shall be rated for the maximum working pressures that can be experienced in the system, but in no case less than 175 psi.

2.4 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.5 ABOVEGROUND PIPING SYSTEMS HANDLING WATER OR FOAM SOLUTION

2.5.1 Pipe

Pipe shall be standard weight conforming to ASTM A 795 or ASTM A 53/A 53M. Pipe 6 inch diameter and smaller shall be Schedule 40. Pipe shall be marked as to the brand or name of the manufacturer, kind of pipe and the ASTM designation in accordance with the "Product Marking" provisions of the ASTM standard.

2.5.2 Grooved Fittings and Couplings

Grooved fittings, couplings and bolts shall be provided by the same manufacturer. Fittings and couplings shall be malleable iron complying with ASTM A 47/A 47M or ductile iron complying with ASTM A 536. Couplings shall be of the rigid type except that flexible type will be provided where flexible joints are specifically required by NFPA 13. Coupling gaskets shall be Grade E (EPDM) approved for dry pipe fire protection service. Gasket shall be the flush type that fills the entire cavity between the coupling and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated. Gaskets must be compatible with foam concentrate and foam/water solution to which it will be exposed.

2.5.3 Non-Grooved Fittings

Non-grooved fittings shall be threaded or flanged. Threaded fittings shall be cast iron conforming to ASME B16.4 or malleable iron conforming to ASME B16.3. Plain-end fittings with mechanical couplings, fittings which require drilling a hole in the pipe, and fittings which use steel gripping devices to bite into the pipe and welded sprinkler fittings or outlets are not allowed in the foam system, shall not be used.

2.5.4 Flanges and Gaskets

Flanges shall conform to NFPA 13 and ASME B16.1. Flanges shall be the type that are welded or threaded to the pipe. Flanges which are bolted to grooved pipe will not be permitted. Gaskets shall be full face type EPDM or other approved material. Gaskets shall be compatible with foam concentrate and to foam/water solution to which it will be exposed.

2.5.4.1 Bolts

Bolts shall be ASTM A 449, Type 1 or 2. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.4.2 Nuts

Nuts shall be ASTM A 193/A 193M, Grade 5.

2.5.4.3 Washers

Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.5 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and be of the type suitable for the application, construction and size pipe involved.

2.5.6 Control Valve

Unless otherwise indicated, valves shall be indicating type in accordance with NFPA 13. Valves 2-1/2 inch and larger shall be flanged outside screw and yoke (OS&Y) type.

2.5.7 Check Valve

Check valves 4 inches and larger shall be flanged, swing type, cast or ductile iron body and cover, cast or ductile iron clapper with replaceable EPDM rubber facing. Valves shall be suitable for either vertical or horizontal mounting and equipped with a removable handhole cover. The direction of flow shall be indicated by an arrow cast in the valve body. The valve body shall include plugged pipe thread connections for a 2 inch drain.

2.6 ABOVEGROUND PIPING SYSTEMS HANDLING FOAM CONCENTRATE

2.6.1 Pipe

Pipe shall be standard weight stainless steel conforming to ASTM A 312/A 312M, Grade TP 304L.

2.6.2 Fittings

Seamless socket weld type or flanged type fittings shall conform to ASTM A 403/A 403M, Grade WP 304L, and shall be compatible with the pipe. Grooved type fittings and couplings shall be of Type 316 Stainless Steel conforming to ASTM A 351/A 351M.

2.6.3 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and be of the type suitable for the application, construction and size pipe involved.

2.6.4 Control Valves

Valve shall be indicating type with full port ball and operating handle that indicates the on/off position of the valve. Unit shall be socket weld or flanged type. Valve body and ball shall be of 316 stainless steel complying with ASTM A 351/A 351M. The valve handle shall be provided with a suitable and substantial means for securing the valve open with a key-operated locking device.

2.7 STRAINER

Welded steel body fire main pipeline strainer, UL listed for fire service. ASTM A 53 pipe and class 150 steel flanges. Hot dipped galvanized per ASTM A 123 Grade 65.

Basket assembly comprised of type 304 stainless steel with 14-gauge screen. Screen to have 1/8 inch diameter perforated holes spaced so as to provide 40% open space.

2.8 AUTOMATIC WATER CONTROL VALVE ASSEMBLY (DELUGE VALVE)

Water control valve shall be an electrically-actuated type rated for a maximum working pressure of 175 psi. The control valve shall be resettable without opening the valve and without the use of special tools. Electrical solenoid valve used to actuate the water control valve shall be an integral component of the valve or shall be approved for use by the water control valve manufacturer and the control panel manufacturer. Solenoid valve shall be of the normally closed, de-energized type which opens when energized upon receipt of an electrical signal from the control panel to which it is connected. Solenoid valves used with diaphragm-type valves shall be rated for a maximum pressure equal to that of the associated valve. Water control valve shall be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly shall be complete with the valve manufacturer's special trim piping, drain and test valves, pressure gauges, and other required appurtenances for foam concentrate use. Each assembly shall include an emergency release device for manually tripping the water control valve in the event of a power or other system failure. Device shall be a standard accessory component of the valve manufacturer and shall be labeled as to its function and method of operation. Valves located in hazardous locations shall be approved for the hazard classification of the area where located. Do not use galvanized or dissimilar components.

2.9 MECHANICAL ALARM DEVICE

Device shall be water-powered and shall include a body housing, impeller wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Minimum 3/4 inch piping shall be provided between the housing and the alarm line trim. Drain piping from the body housing shall be minimum 1 inch steel and shall be arranged to drain to the outside of the building. Piping shall be galvanized both on the inside and on the outside surfaces.

2.10 HIGH EXPANSION FOAM LIQUID CONCENTRATE

Foam concentrate shall be UL listed for use with all selected components. Concentrate shall be the product of one manufacturer. Mixing of non-identical brands of concentrate will not be permitted.

2.11 DIAPHRAGM TANK BALANCED PRESSURE PROPORTIONING SYSTEM

Tank shall be a steel pressure vessel constructed in accordance with ASME BPVC SEC VIII D1. ASME label shall be permanently affixed to the tank. Tank shall be horizontally mounted on steel saddles and shall contain a full internal diaphragm (bladder) having a minimum capacity as shown on drawings. Diaphragm shall be nylon-reinforced Buna-N rubber or other approved material conforming to the inside shape of the tank. Concentrate shall be stored inside the diaphragm and the concentrate shall not be in

contact with the steel tank. The tank shall have perforated PVC tubes installed inside the diaphragm to assure full displacement of the stored concentrate. Tank shall be equipped with the manufacturer's standard fittings and trim, including foam fill and drain connections, water fill and drain connections, and concentrate sight gauge.

2.12 DISCHARGE DEVICES

2.12.1 High Expansion Foam Generators

UL listed water powered generator with stainless steel screen. The generator shall discharge 119 gpm of foam/water solution at 50 psi.

2.13 FOAM CONCENTRATE CONTROL VALVE ASSEMBLY

Assembly shall be specifically designed and constructed to control foam concentrate to proportioners and shall be arranged to open upon application of water pressure from the automatic water control valve to which it is connected. Valve shall be a listed or approved automatic control valve specifically intended for this application or a full port ball valve. All components shall be constructed of brass, bronze or stainless steel, except that the internal portions of listed or approved fire protection valves subjected to foam concentrate may be provided with a coating warranted by the manufacturer to protect the valve from the deleterious effects of the concentrate. All components shall be rated for working pressure of 175 psi or maximum working pressure to which they could be subjected, whichever is greater. Valve shall be certified by the manufacturer to be operable with water inlet pressure as low as 30 psi. Valve components shall be brass, bronze or stainless steel.

2.14 PROPORTIONING DEVICE

Between flange type with body, inlet nozzle, and foam device of ASTM 85-5-5-5.

2.14.1 Pressure Proportioner

The convergent inlet nozzle shall have a rounded inlet and a smooth machined finish to ensure minimum stream constriction and maximum velocity. It shall be retained by an internally concealed retaining ring that prevents removal after installation. The inlet nozzle shall terminate in the foam concentrate annulus chamber and be concentric with and set back from the proportioner recovery section.

2.14.2 Metering Orifice

The foam concentrate metering orifice shall be machined to the proper diameter for the agent. It shall rest on a machined surface to prevent leakage and shall be secured by a removable stainless steel retaining ring.

2.15 FOAM SYSTEM CONTROLS

Panel shall be UL listed or FM approved for "Releasing Device Service" or shall have modules approved for this purpose. Panel shall contain components and equipment required to provide the specified operational and supervisory functions of the system. Components shall be housed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly factory assembled and wired unit. Panel shall include integral "power on," "alarm," and

"trouble" lamps with annunciation of each alarm, supervisory and trouble signal. The panel shall have prominent rigid plastic or metal identification plates for zones, indicating lights, controls, meters, and switches. Lamps and fuses mounted on circuit boards shall be identified by permanent markings on the circuit board. Nameplates for fuses shall also include ampere rating. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meter and lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate and annunciate, by zone, any alarm, supervisory or trouble condition on the system. Upon restoration of power, start-up shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

2.15.1 Zone Annunciator

Visual annunciators shall be provided for each active zone and spare zone. A separate alarm and trouble lamp shall be provided for each zone and shall be located on the exterior of the cabinet door or be visible through the door. A minimum of two spare alarm zones that are fully operational shall be provided. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic or metal sign with either raised, engraved or silk-screened letters. Zone identification shall consist of a unique zone number as well as a word description of the zone. Zones shall be arranged as shown on the drawings.

2.15.2 System Zoning

The system shall be zoned as follows:

ZONE NO.	DESCRIPTION
1	Pump Room
2	Foam Room
3	Hangar Area
4	Ancillary Area

2.15.3 Primary Power Supply

Primary power and trouble alarm . Power to the control panel shall be as indicated. Panel shall be permanently marked "FOAM FIRE PROTECTION SYSTEM".

2.15.4 Emergency Power Supply

Emergency power shall be provided for system operation in the event of failure of the primary power supply and shall consist of rechargeable storage battery system. Transfer from normal to emergency power or restoration from emergency to normal power shall be automatic and shall not cause transmission of a false alarm.

2.15.4.1 Storage Batteries

Storage Batteries shall be sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the system for a period of 90 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate alarm indicating devices in the alarm mode for a minimum period of 15 minutes. Battery cabinet shall be a separate

compartment within the control panel. The battery compartment or cabinet shall have twice the volume of the batteries. Batteries shall set on a non-corrosive and non-conductive base or pad. Batteries in the control panel shall be located at the bottom of the panel.

2.15.4.2 Battery Charger

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 24 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel cabinet.

2.21 ALARM INITIATING DEVICES

2.16 Waterflow Pressure Alarm Switch

Unit shall include a 1/2 inch NPT male pipe thread, two 1/2 inch conduit knockouts, and two sets of SPDT (Form C) contacts. The switches shall be factory adjusted to transfer the contacts at 4 to 8 psi on rising pressure. Unit shall include a water-tight NEMA 4 die-cast aluminum housing with a tamper resistant cover which requires a special key for removal. The cover shall be provided with a tamper switch which shall operate upon removal of the cover. Units used on wet-pipe systems shall have an adjustable, instantly recycling pneumatic retard to prevent false alarms due to water pressure variation. Retard adjustment shall be factory set at approximately 20-40 seconds and adjustable between 0-90 seconds.

2.17 Vane-type Waterflow Switch

Assembly shall consist of a cast aluminum pipe saddle housing an electro-mechanical device to which is attached a flexible, low-density polyethylene paddle. The paddle shall conform to the inside diameter of the fire protection pipe and sense water or solution movements. The waterflow indicator shall be capable of detecting a sustained flow exceeding 10 gpm. Assembly shall contain a pneumatic retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The unit shall include two sets of SPDT (Form C) contacts. The unit shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.18 VALVE SUPERVISORY (TAMPER) SWITCH

Switch shall be designed to monitor the open condition of each water or foam concentrate control valve to which it is mounted. It shall include a cast aluminum housing, tamper proof cover, two sets of single pole, double throw (SPDT) contacts and brackets and J-bolts needed for mounting. Removal of the cover shall cause both switches to operate.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Aboveground Piping

Piping shall be installed straight and bear evenly on hangers and supports.

Piping shall be concealed in areas with suspended ceiling and shall be inspected, tested and approved before being concealed.

3.1.1.1 Joints

Pipe joints shall conform to NFPA 13. Not more than four threads shall show after joint is made up. Joint compound shall be applied to male threads only. Joints shall be faced true, provided with gaskets and made square and tight. Flanged joints or mechanical groove couplings shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published installation instructions. All grooved couplings and fittings shall be from the same manufacturer. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.1.2 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.1.1.3 Pipe Supports and Hangers

Installation methods outlined in NFPA 13 are mandatory. Protection of piping **and all foam equipment including foam tanks and generators** against damage from earthquakes shall be provided. Longitudinal and lateral sway bracing shall be provided for piping 2-1/2 inch diameter and larger. Design to seismic zone 3 per NFPA 13

3.1.1.4 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes penetrating concrete or masonry walls or concrete floors shall be provided with pipe sleeves fitted into place at the time of construction through its respective wall or floor, and shall be cut flush with each surface. Sleeve sizes and clearance between pipe and sleeve shall be in accordance with NFPA 13. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07840A FIRESTOPPING.

3.1.1.5 Escutcheons

Escutcheons shall be provided at finished surfaces where exposed piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe and shall be chromium-plated iron or chromium-plated brass, either one-piece or

split-pattern, held in place by internal spring tension or setscrew.

3.1.1.6 Drains

Main drain piping shall be provided to discharge at safe points outside each building. Drains shall be of adequate size to readily receive the full flow from each drain under maximum pressure. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line. Each drain valve shall be provided with a metal sign identifying the type of drain connection or function of the valve.

3.1.1.7 Identification Signs

Signs shall be in accordance with NFPA 13. Properly lettered and approved metal signs shall be suitably affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate. See drawings for additional sign requirements.

3.1.2 Underground Piping

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. The supply line shall terminate inside the building with a flanged piece. A blind flange shall be installed temporarily on the flanged piece to prevent the entrance of foreign matter into the supply line. Joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be coated with a bituminous material.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

Earthwork shall be performed in accordance with applicable provisions of Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.3 ELECTRICAL WORK

Unless otherwise specified, power supply equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR.

3.3.1 Overcurrent and Surge Protection

Equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. Cables and conductors which serve as communication links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.3.2 Grounding

Grounding shall be provided to building ground.

3.3.3 Wiring

System field wiring shall be installed in 3/4 inch minimum diameter electrical metallic tubing or metallic conduit. Wiring for the sprinkler system fire detection and control system shall be installed in tubing or conduits dedicated for that use only and shall not be installed in conduit,

outlet boxes or junction boxes which contain lighting and power wiring or equipment. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked and labeled in accordance with the wiring diagram. No more than one conductor shall be installed under any screw terminal. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors is not permitted. Wiring within any control equipment shall be readily accessible without removing any component parts.

Conductors shall be color coded and shall be identified within each enclosure where a connection or termination is made. Conductor identification shall be by plastic coated, self-sticking, printed markers, or by heat-shrink type sleeves. Circuits shall be wired to maintain electrical supervision so that removal of any single wire from any device shall cause a "trouble" condition on the control panel. Wiring for foam system controls to be Class A wiring with redundant conduit (in NFPA style 6 for signaling line circuits, Style Z for notification appliance circuits). Refer to electrical contract documents for hazardous requirements.

3.3.4 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 24 inches nor more than 78 inches above the finished floor.

3.3.5 Manual Actuation Stations

Manual actuation stations shall be mounted readily accessible and 42 inches above the finished floor.

3.3.6 Notification Appliances

Notification appliances shall be mounted a minimum of 8 feet above the finished floor unless limited by ceiling height.

3.4 PIPE PAINTING AND LABELING

3.4.1 Painting

Black steel pipe shall be painted in accordance with the requirements specified under SECTION 09900 PAINTING, GENERAL. Pipe in equipment rooms may be left unpainted. Pipe in other areas shall be painted to match finishes in those areas. Stainless steel pipe shall not be painted.

3.4.2 Pipe Identification

Aboveground pipe 2 inch diameter and larger shall be identified with legends. Legends shall include FOAM CONCENTRATE, HIGH EXPANSION FOAM, and FIRE PROTECTION WATER. Legends shall utilize WHITE letters on a RED color field and shall include arrows to indicate the direction of flow. Length of color field, letter size and locations on piping shall be as recommended in ANSI A13.1.

3.5 PRELIMINARY TESTS

Tests shall be performed to make adjustments in the fire protection system operation and to verify that the system will function as intended and that it is ready for service. Such tests shall include all components and subsystems. Test results shall be clearly documented and included with the

written request for Final Test.

3.5.1 Flushing

Underground water mains shall be flushed in accordance with NFPA 13 and NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the maximum water demand rate of the system.

3.5.2 Hydrostatic Tests

The underground and aboveground piping systems, including AFFF concentrate, shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi, or 50 psi in excess of maximum system operating pressure, for 2 hours. There shall be no visible leakage from the piping when the system is subjected to the hydrostatic test.

3.5.3 Automatic Water Control Valves

Each valve shall be tested to verify operation in accordance with manufacturer's published operating instructions. This shall include tests of valves and switches connected thereto.

3.5.4 Foam Generators

Foam generators shall be discharged tested for proper operation and coverage.

3.5.5 Foam Concentrate System

Tests shall be conducted under the supervision of a technical representative employed by the foam concentrate manufacturer. The complete foam concentrate system shall be adjusted and tested to assure proper operation. Test results, including all pressure settings and readings, shall be recorded on an appropriate test form signed and dated by manufacturer's representative certifying that the system is in compliance with contract requirements and the manufacturer's recommended practices. Testing shall include, but not be limited to, the following:

- a. Filling the foam concentrate tank.
- b. Adjustment of proportioners.
- c. Collection of foam samples and testing with a conductivity meter to verify proportioning accuracy.
- d. Other operational checks recommended by the AFFF proportioner manufacturer.

3.5.6 Control System Tests

Tests shall be conducted under the supervision of a factory-trained representative of the control panel manufacturer. The electrical control system shall be tested to verify that the control panel and all wiring have been installed correctly and that all components function as intended. Tests shall be conducted using normal operating and battery power. Testing shall include, but not be limited to, each of the following:

- a. Alarm initiating circuit and device. This shall include manual

actuation stations, waterflow and pressure switches, and similar devices connected to the control panel.

- b. Supervisory circuit and device. This shall include valve supervisory (tamper) switches, and similar circuits and devices.
- c. Actuation circuit and device. This shall include circuits to automatic water control valves, fire pumps, and similar circuits related to system activation.
- d. Annunciator lamp and notification appliance. This shall include bells, horns, electronic signaling, and similar devices.

3.6 FINAL TEST

3.6.1 Requirements

The Final Test shall be a repeat of Preliminary Tests, except that flushing and hydrostatic tests shall not be repeated. In addition, the system shall be automatically actuated and allowed to discharge for a period long enough to verify compliance with design requirements prior to shutting the system off. The Contractor shall correct system failures and other deficiencies identified during testing and shall retest portions of the system affected by the required corrections.

3.6.1.1 Pretest Requirements

The system will be considered ready for final testing only after the following have been accomplished.

- a. The required test plan has been submitted and approved.
- b. Preliminary tests have been made and deficiencies determined to have been corrected to the satisfaction of the equipment manufacturer's technical representatives and the Contracting Officer.
- c. Test reports, including the required videotape of the preliminary tests, have been submitted and approved.
- d. The control panels shall have been in service for a break-in period of at least 14 consecutive days prior to the final test.
- e. The Contractor has provided written notification to the Contracting Officer, at least 21 days prior to date of Final Test, that preliminary tests have been successfully completed.

3.6.1.2 Videotaping

Contractor shall videotape the tests in VHS format and shall record the date and time-lapse, in seconds, from start to finish of each portion of the test as directed by the Contracting Officer. Four copies of the tape shall be submitted before the system will be considered accepted.

3.6.1.3 Manufacturer's Services

Experienced technicians regularly employed by the Contractor in the installation of the system and manufacturer's representative referred to elsewhere in this specification shall conduct the testing.

3.6.1.4 Materials and Equipment

Contractor shall provide concentrate, gauges, sample collection apparatus, instruments, hose, personnel, elevating platforms, scaffolding, ladders, appliances and any other equipment necessary to fulfill testing requirements specified.

3.6.1.5 Facility and Environmental Protection

Contractor shall provide protection for the facility, including electrical and mechanical equipment exposed to possible damage during discharge tests.

This shall include provision of sandbags or similar means for preventing migration of foam solution into adjacent areas. Temporary measures shall be provided to prevent foam solution from entering storm drains, sanitary sewers, drainage ditches, streams and other water sources. Discharged foam shall be contained on paved surfaces and shall not be allowed to come in contact with the earth.

3.6.2 Control System Tests

Operational features of the control system shall be tested and demonstrated. This shall include testing of control panels and each input and output circuit. Tests of circuits shall include actuation and simulated circuit fault at each initiating, notification, supervisory and actuation device or appliance. As a practical matter, these tests shall be a repeat of preliminary tests required under paragraph PRELIMINARY TESTS.

3.6.3 Proportioning System Tests

Each proportioner (ratio controller) shall be flow tested to determine that proportioning accuracy is within specified limits. Each proportioner supplying a deluge system shall be tested at the design flow rate. Foam samples from each proportioner shall be accomplished in accordance with NFPA 16, NFPA 16A and the approved test plan. Foam solution concentrations shall be determined using the methods outlined in NFPA 16 and NFPA 16A. Proportioning shall be between the listed percent and 1 percent above the listed percent. If test results indicate proportioning below or above this range, the Contractor shall make necessary adjustments and retest as directed by the Contracting Officer.

3.6.4 Post-discharge Test Requirements

Following the successful completion of the tests, the Contractor shall remove the foam solution from the site as indicated on the approved foam waste containment and disposal plan. Contractor shall replenish foam concentrate consumed during the tests. The entire fire protection system shall be returned to automatic operation and the facility restored to operational capability. Discharged solution shall be contained and disposed of in a manner acceptable to local authorities and as identified on the approved test plan. Once tests are completed, systems shall be returned to fully operational status, including filling of AFFF concentrate tanks with concentrate and filling of solution piping with premix as required.

3.7 POSTED INSTRUCTIONS

Framed description of system operation, instructions and schematic diagrams of the overall foam system and each subsystem, shall be posted where

directed. Condensed operating instructions explaining the system for normal operation, refilling the foam storage tank, and routine testing shall be included.

3.8 TRAINING

Contractor shall provide at least two training sessions of at least 6 hours each to explain system's operation and maintenance. Training sessions shall be conducted on alternate days to afford flexibility by shift personnel and other attendees. Training sessions shall include classroom instruction and explanation of approved Operation and Maintenance Manuals. Training aids shall be provided as necessary to clearly describe the systems. In addition to classroom instruction, systems shall be operated to provide hands-on demonstrations. Contractor shall include a system actuation using water only, to demonstrate system operation and procedures for resetting the system. Training areas will be provided by the Government in the building where the systems are installed. Dates and times of the training sessions shall be coordinated with the Contracting Officer not less than 15 calendar days prior to the first session.

-- End of Section --